ENGINEERING NEWS

Tribune Building, New York City.

GEO. H. FROST, PROPRIETOR.

SATURDAY, JUNE 18, 1881.

OWING to the unusual press of business and delays caused by altering drawings, we are obliged to omit our article on the New York and Brooklyn Bridge for this issue.

THE St. Gothard Tunnel cost the lives of sixty nine persons in 1880. Twenty perished in the line Immensée, twenty-two in the large tunnel, twenty one in the line Aurolo-Biasca and six in the line Monte-Cenere. Falling rocks and mine explosions were the principal causes of the accidents.

WE have received notice of the sale of the patents, stock and good will of the firm of W. E. Desper & Co., Worcester, Mass., manufacturers of the Desper water meter, to the Continental Water Meter Co., of Boston, Mass. The old firm will continue in the employ of the company, devoting personal attention to the business.

THE Semi-Centennial Exhibition of the American Institute of this city will open on September 14 next. The exhibits will be for the benefit of inventors and manufacturers, giving them an opportunity for the display of their various products. Heavy machinery will be received as early as August 23; other goods September 5. All desired information will be furnished by the General Superintendent American Institute, New York City.

THE new charter for the city of New Haven, Conn., increases the executive boards of the City Government from five members to six, and makes the Mayor chairman *ex-officio* of each. Some change in the titles is also made in the street department. The Board of Road Commissioners is changed to the Board of Public Works, the City Surveyor to City Engineer, and the City Inspector to Superintendent of Streets—titles more in keeping with the duties of the offices. The limits of the city are also extended slightly.

MEMBERS and guests of the American Society of Civil Engineers, to the number of about ninety, met at Niagara Falls on Saturday, the 11th, and on the 15th the thirteenth annual convention was opened at Montreal according to the programme already published, with over one hundred members and visitors in attendance. The convention has been a very successful one, and in the enjoyment of its many social and intellectual pleasures, our correspondent has found so little time to devote to reportorial enterprise that we will defer till next week the full account of the week's proceedings.

THE Common Council of Buffalo now have before them a resolution proposing to offer an award of $25,000 with a view toward securing the invention of a system for utilizing the currents of the Niagara River in producing power for manufacturing purposes, lighting the city by electricity and other purposes; twenty thousand dollars to be given to the inventor of the best system and five thousand to the second. The resolution has been referred to the Committee on Finance. Now that electricity can be generated in one place, stored in a box and sent to a distant locality there to deliver its confined powers, the immense forces of the Niagara may be utilized in places not adjacent like Buffalo.

PERSONAL.

Charles B. Phillips, Captain United States Engineers in charge of the harbor and river improvements in the Norfolk, Va., district, died on the 14th inst. His remains were taken to Boston for interment.

Mr. S. B. McKee, of Moriah Center, N. Y., formerly assistant engineer on the New York, Ontario & Western Railroad, has accepted an engagement with the Wisconsin & Michigan Railroad as resident engineer, with headquarters at Ontonagon, Mich.

Mr. Daniel R. Kelly, a prominent contractor of this city, is at present engaged, for capitalists of Boston, in dismantling the Sawyer Observatory Tower, in Philadelphia, for the purpose of removing it to Revere Beach, Boston. The work is to be finished in sixty days from commencement.

Charles H. Stone, Chief Engineer of the United States revenue cutter Commodore Perry, died suddenly on board that vessel in the harbor at Toledo on Sunday. He was forty-one years of age and had been in the service twenty-five years. Mr. Stone leaves a wife and child in Philadelphia. His remains were taken in charge by the Knights Templar and were forwarded to Erie, Pa.

Mr. James S. Coleman, the newly appointed Commissioner of Street-Cleaning for the city of New York, is a young man, not more than thirty-eight years of age. He was educated in one of the public schools of New York, and has been engaged as contractor and superintendent of various important public works in different parts of the country. He was connected with the construction of the Morris & Essex, the New Jersey Central, the Delaware, Lackawanna, & Western, and other Eastern railways. For the past year he has been engaged in building the Texas Pacific Railway and in constructing bridges across the Brazos and other rivers in Texas. He is now constructing the new tunnel between Weehawken and New Durham for the New York, Ontario & Western Railway. For several years Mr. Coleman has been a director in the New Jersey Southern Railway Company, and in the National Iron Bank at Morristown, N. J., a trustee of the Morris County Savings Bank, and an associate of William Walter Phelps, Fitz-John Porter, H. L. Marsh and James King as a trustee of the Washington Association for the preservation of Washington's headquarters at Morristown, N. J., for which $50,000 was lately raised by private subscription. He is tall and spare in figure, with gray hair, mustache and goatee. He has a house in this city and also one in Madison, N. J., where his parents live. In reply to questions put to him by a *Tribune* reporter, Mr. Coleman said: "I believe that the streets can be kept clean, and I will at least undertake the task. The present system does not meet the approval of the people, and therefore it will have to be changed. I have given a good deal of attention to the matter, and have some ideas. Also, many suggestions have been made to me in regard to collecting and disposing of the garbage and ashes, but I do not care to state them at present. I would rather perform the work, and let the public judge of the wisdom of my plans. I have had my own views about cleaning the streets for years. Two or three years ago I sent a bid to the Police Commissioners, offering to do the work at a figure much less than the appropriation for the Commissioners. I also offered to furnish a million dollars as a bond for the faithful performance of the work. The board wrangled over the bid for several months, and finally it was rejected. My plans for cleaning the streets have not materially changed since then."—*Harper's Weekly.*

TUNNELING WITH A PILOT.

In extending the work on the northern portion of the Hudson River Tunnel before the accident, the outer sheathing of plates was put in position as soon as the excavation was made, and was held by struts resting upon the bottom and opposite sides. By this means the silt was excluded while the masonry was being built. Although the utmost celerity was used in getting the plates and struts in position, the slight excess of the combined weight of silt and water over the air pressure would force the plates down and out of position sufficiently to make it almost impossible to maintain an accurate alignment. Endeavors were made to allow for this settling, but the variation in the weight of the upper material and its slight changes in compactness, and the fluctuations of the resisting pressure, constituted data which were uncertain, and from which no satisfactory results could be obtained.

It was while prosecuting this work that Mr. J. F. Anderson, the then superintendent of the tunnel, conceived the idea of running a pilot in advance of the head, but it was not until after the accident that he put his plans into practical operation.

The south tunnel had been built but a short distance, and after the side of the caisson had been cut through and the arches completed, a bulkhead was placed across the caisson and through a series of pipes silt was forced through from the air chamber in order to fill the space behind the bulkhead with a material that would be sufficiently compact to prevent the escape of air. As soon as this was accomplished the central portion of the bulkhead was removed and the plates for the pilot introduced. This pilot has been used in advancing the work during the past six months, and has fully demonstrated its great saving of risk and time, and has suggested its adaptability to tunneling in places where the earth is composed of soft materials.

Fig. 1 represents a cross-section of a pilot tunnel composed of ten segmental, interchangeable plates of the length of a section, and united by means of angle irons riveted to the inner sides along the longitudinal edges. Between the joints are placed longitudinal joint plates, shown at *E E*, which project a few inches from the outer surface of the pilot, thus forming a series of ribs. Circular angle irons are riveted to the ends of each plate; between each joint is placed a plate which projects beyond the outer surface of the pilot, a distance varying according to the nature of the material being worked, and forms a transverse rib. The struts or braces *J J* rest against the pilot tunnel next to the transverse plates and support the outer shell and masonry of the main tunnel, and also that part of the pilot extending into the finished work. Fig. 2 represents a cross-sectional elevation of the joint of the plates forming the section of the pilot-tunnel.

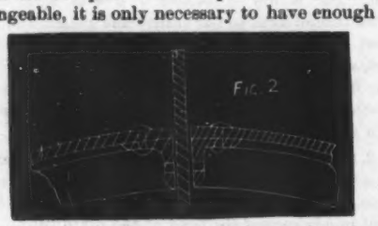
A few of the advantages to be gained by the use of a pilot of this description we will briefly mention. As the front end of the pilot is from 25 to 30 feet in advance of the head of the main tunnel, the ground through which the latter will have to pass can be explored, and if any leaks or breaks are encountered they can be stopped much more easily and safely in the head of the pilot than in the main tunnel. Laborers in the main tunnel can be notified of any impending danger, and precautionary measures taken for the safety of all persons connected with the work. In building tunnels in soft materials it has been customary to bank the head of the tunnel in order to form resting places for the braces to support the upper portion of the arch. The immense pressure would cause these to give way, and the large number of braces would so fill the working space as to interfere considerably with the workmen. The pilot also assists in

preventing the earth at the tunnel head from caving in, for the upper portion of the earth rests on the pilot, and the distance between the bottom of the pilot and the bottom of the main tunnel is not large enough to permit the earth to slide. As all the braces are radial ones they can be considerably shorter than the radius of the tunnel, and consequently can be of much smaller cross-section, and can be more conveniently and rapidly handled than the heavy braces used with tunnel-shields or with a banked heading.

The longitudinal ribs stiffen the pilot, while the transverse ribs not only stiffen it but also form anchors to keep it in advance of the heading for the enormous pressure would tend to force it into the completed tunnel. When operating in material which will flow rapidly when mixed with a small quantity of water—as is the case with the silt in the Hudson River Tunnel—the tendency of this material is to flow back along the exterior of the pilot

and thence down the heading. To obviate this the transverse joint-plates can be made of any width in order to present a surface of sufficient area to prevent any disposition of the earth to escape along the pilot.

As all the plates of the pilot are made interchangeable, it is only necessary to have enough to



make a tube of from 50 to 60 feet in length—25 or 30 feet being in advance of the heading and the remainder in the rear. As it becomes essential to extend the forward end the plates from the rear are unbolted, carried ahead through the pilot and placed in their new position. This would lessen the aggregate cost of the work in the two most important items—labor and materials. In tunneling in materials and at depths which would subject the pilot to immense pressures, especially after the struts had been placed in position to sustain the tunnel plates, the plates, angles and joint-plates could be made of a thickness which would resist the load. In cases where this would only be encountered for a short distance, not sufficient to compensate for the increased cost, struts could be placed in the pilot itself, and still leave ample room for the men.

In certain localities which will be passed under by the contemplated underground railroads of this city it has been decided to build the tunnel by means of an open cut, as described in ENGINEERING NEWS, Vol. VII., page 371. When this cut is extended to the foundations of adjacent buildings they will be endangered if resting on any loose material unless the sides of the cut are sheathed and strongly braced. The pilot would seem to obviate this difficulty, as the pressure is being constantly supported, and as the work itself would constitue a kind of detector, giving warning by its yielding of any undue strains.

By inserting an extra number of joint-plates in one side of the pilot, its course can be changed either vertically or horizontally, as may be needed.

Mr. Anderson has recently secured United States patents upon the above device. Several eminent engineers who have examined the workings of the pilot in the Hudson tunnel have pronounced unqualifiedly in its favor, and predicted that its use would result in much saving of time and labor.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 235.)

PITTSBURGH (CONTINUED).

The engines are coupled in pairs, the cylinders are horizontal and the pumps vertical. The change of direction is effected by a triangular beam. One pair is fitted as a compound engine with low pressure cylinders of 106-in. diameter. The high pressure engine carrying 121 lbs. of steam pressure and 165 lbs. water pressure on the pumps makes 8 revolutions per minute.

The compound engine is run at 9½ and 10 revolutions. Great delay occurred in the completion of the engines and several breakages took place which were attributed by the designer, Mr. Joseph P. Lowry, to the use of metal inferior to that called for by his specifications, but by the builder, Mr. Hartuppee, to inherent defects in the design. On one occasion one of the plungers broke in two. The foundation of the engine-house is 19.25 ft. below low-water in the river, in shaley gravel and earth, and the walls are 55 ft. high.

* Copyright 1881.

The original design of Messrs. Lane and Chesbrough contemlated the construction of a reservoir at Brilliant Hill 208 ft. above the river. Its construction was begun in 1872, but work was suspended after an expenditure of $128,000, and it remains unfinished. The Hiland avenue reservoir has an area of about 18 acres at 335½ ft. above the river. It is in excavation and embankment, and the slopes are lined with 15 in. of stone pavement, with 5 in. backing of broken stone. In the spring of 1880 the slope wall for about 300 ft. in length, on the south side of the division embankment, slid into the reservoir bodily. It was repaired in 1881. The bank back of the wall was removed for several feet, and clay and gravel put on in thin layers, moistened and thoroughly rammed.

About three miles from this reservoir the high-service engine takes water from the mains, and lifts it 275 ft. to the Herron Hill reservoir, which has a capacity of 10 million gallons, and is 530 ft. above the river

The engine house is a cut-stone building, erected on a sloping hill-side, the lower portion of which was of clay, full of springs. The boiler-house was built on that side, and in April, 1881, the boiler-house and the north wall of the engine-house settled several inches, broke the building in two and began to go down hill.

The Herron Hill reservoir is a rectangle, 350x600 ft. and 24 ft. deep. The slopes are lined with 15-in. stone paving, laid in cement on five inches of broken stone. After its completion in 1879, some leaks showed themselves, the water passing out through crevices in the rock and appearing in springs on the hill side 70 ft. below the reservoir.

Additional pumping works were built in 1870, at Forty-fifth street, about two miles above the old works. Three engines, of an aggregate capacity of one and a half million gallons per day, pumped directly into the main. On every rise of the river the pipes and pumps were choked up with sand, frequently cutting the supply off from the consumers. It has been the intention to abandon these works on the full completion of the new water-works.

In 1864 pumping works were erected on the south side of the Monongahela River for the supply of that portion of the city. The water is drawn through pipes laid out into the stream, and there have been frequent complaints of the impurity of the water. The pumps deliver water into a reservoir. These works were built by a private company. The city pays for the fire hydrants, of which 154 were in position in January, 1880.

The distribution pipes are of cast iron. The old pipes were laid without much system, and their location and length are not known with exactness. Most of them were cast horizontally and vary greatly in thickness. The increased pressure from the new works has caused a great number of leaks and breaks. Many of the pipes which broke were found to be badly corroded.

In 1880, the population being 156,381, there were 112.5 miles of pipe in use and the consumption was 16 million gallons per day.

There are 770 fire hydrants in the old city.

The number of taps before 1868 is not given in the reports. In 1868 there were 43 miles of pipe, and during the 11 following years 69.5 miles of pipe have been laid and 6,451 taps inserted.

The cost of the works from 1824 to 1872 was $1,627,860.12. The cost of construction of the new works is not reported. The revenue for the 8 years from 1872 to 1879 was $2,117,450.39, and the expense for maintenance for the same period was $792,190.30. The expenditures in 1880 were $129,883.11.

The works are managed by a superintendent, who reports to the Water Committee of the Common Council. James M. Atkinson has been the superintendent for a number of years.

The new works were built by a Special Commission and on their completion placed in the superintendent's charge.

XXVI.—ALLEGHENY.

Allegheny, Pennsylvania, is on the west bank of the Allegheny and Ohio rivers at their confluence, opposite Pittsburgh and the mouth of the Monongahela River. The city limits comprise 7.24 sq. miles, extending 2.5 miles on the Allegheny and 4 miles on the Ohio River. Near the rivers the ground is quite level, but at from a mile to a mile and a half back it rises quite abruptly to 500 and 600 ft. above the rivers.

The hill-sides are cut by five or six ravines in which small streams flow. The peculiar position and topography cause occasional excessive falls of rain in the ravines, producing sudden freshets which cause great damage.

In 1847, the population being about 18,000, waterworks were constructed after the plans of R. Moore. Water is taken from the Allegheny River a mile and a half above its mouth, by two cast iron 24-in. pipes extending 500 ft. from the shore into the channel. The first pumping engine consisted of two lever engines, coupled together, with cylinders of 22-in. diameter and 96-in. stroke, and pumps with 12-in. bore and 96-in. stroke. The capacity of the pumps was 1.5 million gallons per day. These engines were duplicated in 1854. In 1874 a Lowry engine was added, with horizontal cylinders of 44-in. diameter and 168-in stroke, operating by a triangular beam, two vertical plunger pumps of 36-in. bore and 132-in stroke.

The water is lifted 217 ft. to a reservoir 600 ft. distant, built in excavation and embankment, the bottom covered with 18 in. of puddle, on which a 2-in. pavement of brick is laid in sand, and the slopes lined with 24 in. of puddle paved with 4 in. of brick laid in cement.

A wall of stone masonry, with a footing of concrete on puddle, divides the reservoir into two basins.

Its water surface is about 1¼ acres and its capacity 9,600,000 gallons.

The distribution pipes are of cast iron. In 1879 there were 55 miles of pipe and 625 hydrants. The cost of the works, exclusive of maintenance, has been $1,100,000. The annual cost of maintenance is now about $35,000, and the consumption three million gallons per day, and the revenue $135,000.

From 1850 to 1876 the receipts exceeded the current expenses by $508,103.

The works are managed by a superintendent, who reports to the Common Council. This position is held by H. C. Richmond.

(TO BE CONTINUED.)

Received from Francis J. Power, Superintendent Water Company, Alexandria, Va., reports for 1851, 1852, 1853, 1855, 1857, 1859, 1866, 1867 and 1879.

BOOK NOTICES.

Two recent numbers of Van Nostrand's Science Series are

No. 52.—Imaginary Quantities: their geometrical interpretation—a translation from the French of M. Argand, by Prof. A. S. Hardy; and

No. 53.—Induction Coils: how made and how used—a reprint of an English work by Dyer. (Price of each 50c.)

The former little book will open in a surprising way to many readers a new field for the graphical representation of analytical processes, and it proves the term *imaginary quantity* to be a misnomer, since the geometrical symbol can be simply constructed.

The latter volume is intended for teachers and experimenters. It explains the methods of producing electric currents, the construction of induction coils, and the construction and use of the accompanying apparatus for class-room or other experiments. It is fully illustrated, and will doubtless be found to be a very handy little manual.

Working Drawings: how to make and use them—by Prof. L. M. Haupt. Philadelphia: J. M. Stoddart & Co. (75c.). A small volume of some sixty pages of text and nine plates of figures, giving the principles of descriptive geometry, so far as they apply to straight lines and planes, with illustrative problems. It is designed by the author for introduction into industrial and higher grade grammar schools, night schools, and for artisans desiring a guide to the principles of projections. We think the book may be found very helpful in an industrial or other school where a teacher is at hand to enforce and to enlarge upon the propositions laid down; but we do not feel sure that the artisan or unassisted reader of moderate ability will succeed so well in attempting to master the first principles of descriptive geometry as given here, as he will by the aid of some other works on geometrical and projection drawing.

The Figure of the Earth. An introduction to Geodesy, by Prof. Mansfield Merriman. ($1.50.)

A few familiar lectures on the above subject to the civil engineering students of Lehigh University have been revised and enlarged, and are now presented to the public in book form. Within, in the limits of some eighty pages, crown octavo, the author explains how the figure of the earth, considered as a sphere, a spheroid, an ellipsoid, an ovaloid or a geoid, can be approximated to, with increasing accuracy, as measurements of meridian arcs, upon different parts of the earth's surface, increase in number. The discussion, which is written in a clear and pleasing style, can be easily followed by the unprofessional reader, who may be interested in the subject, and is well illustrated by cuts and by numerical examples. The results obtained by Clarke, Bessel and others are given, and abundant foot-notes refer the reader to sources of more extended information. The prospective student of geodesy ought to find here a bright and attractive presentation of the field upon which he desires to enter.

AN IMPROVED TURNTABLE.

Center-bearing turntables are preferred over rim bearing, and even combined rim and center-bearing tables, on account of turning under a heavy locomotive with greater ease, consequent upon the turning-joint in center-bearing tables being of the least possible diameter, thereby, of course, proportionately lessening the friction.

Combined rim and center-bearing tables have the advantage of not *tipping*, which is the greatest objection to first-named class of turntables.

It is a well-known fact that the structure forming the platform (or that part of turntable to be rotated) must be *rigid* to stand the various strains that are brought to bear upon it in almost every direction, with but slight deflection, though supported at center only on a small diameter, say 12 or 15 inches.

Two beams are almost always employed in the construction of a turntable, but should be considered, and act, as *one beam*. The cast-iron turntable has this quality, but owing to the nature of this material, wrought iron is fast displacing cast iron in engineering structures.

It is impossible to calculate the sectional area of cast-iron with certainty, for flaws and cavities in casting, caused (even when iron and mold are both "clean") by gases that are retained inside the metal when it sets to a solid, which cut away the section in places that do not appear on the surface. In wrought iron these defects are squeezed, hammered and rolled out. Therefore, a more satisfactory estimate of strength of the latter can be made.

What seems to the inventor to be a desirable turntable is a *center-bearing, non-tipping* table, composed of *reliable* material, and after ten year's practice in this specialty, has produced the herein illustrated and described turntable.

Fig. 1 is a side elevation of table (masonry shown in section).

Fig. 2. Transverse vertical section at center.

Fig. 3. One-half of longitudinal vertical section at center.

Fig. 4. Sectional view of truck at *C D* (showing adjustment).

Fig. 5. Section of table at *A B*, showing struts and vibration bolts.

Figs. 6 and 7. Section of stay bolt and countersunk washer.

Fig. 8. Cross tie for circular track.

Fig. 9. Section of truck at *E F*, showing truck wheel and axle.

Fig. 10. Sectional end view of table, showing truck frame, etc.

Fig. 11. Ground plan of table.

Figs. 12, 13 and 14 show locking attachment.

Fig. 15 shows center bracing inside of center box.

The table as shown in Figs. 1 and 11 is 59 feet long, weighs 33,000 lbs., and is composed of two plate girders (truss beam in form); each girder has a web plate ⅜″ thick throughout × 48″ wide at center; provided with 18 vertical stiffeners of T iron 2½″×5″×12 lbs., bent to fit web and angle irons without the use of filling plates; fastened with ⅞″ rivets, 6″ pitch. Two rivets at each end of each set of stiffeners pass through the angle-irons that form top and bottom chords of girders; each web has but two joints, one at third and one at seventh set of stiffeners. All edges of plates are to be dressed and firmly drawn together in riveting. The top chord of each girder is composed of five plates 8″ wide × ⅜″ thick, and their lengths are respectively 59, 49, 39, 29 and 19 feet. These are connected with the web by two angle-irons 3½″×3½″×10 lbs. per lineal foot, riveted with ⅞″ rivets 3″ pitch in row that takes webs, and 6″ pitch through chord plates.

The upper and lower chords are the same, except all members of top chord are continuous (without splice). The bottom chord has one joint at center in longest plate, and the two angle irons; the remaining plates used in bottom chord are continuous also.

The above described beams are connected one to the other by one central box, eight strut-plates, 32 strut braces, 16 vertical, and 16 lateral vibration bolts; also four stay bolts furnished with wrought iron pipe struts.

The strut plates are full width of beams, ⅜″ thick, and riveted to the inside stiffeners with ¾″ rivets, 3″ pitch.

Strut braces are 16 pieces of 2¼″×2¼″×6 lbs. angle, and 16 pieces 4″×3″×8 lbs. T iron; the angle iron riveted to chords with two ¾″ rivets in each end; the T iron in addition to being riveted to chords is also riveted to strut plates with ¾″ rivets, 3″ pitch.

The vertical vibration bolts are ⅞″ diameter, enlarged ends furnished with two 1″ nuts. (For arrangement see Fig. 5.)

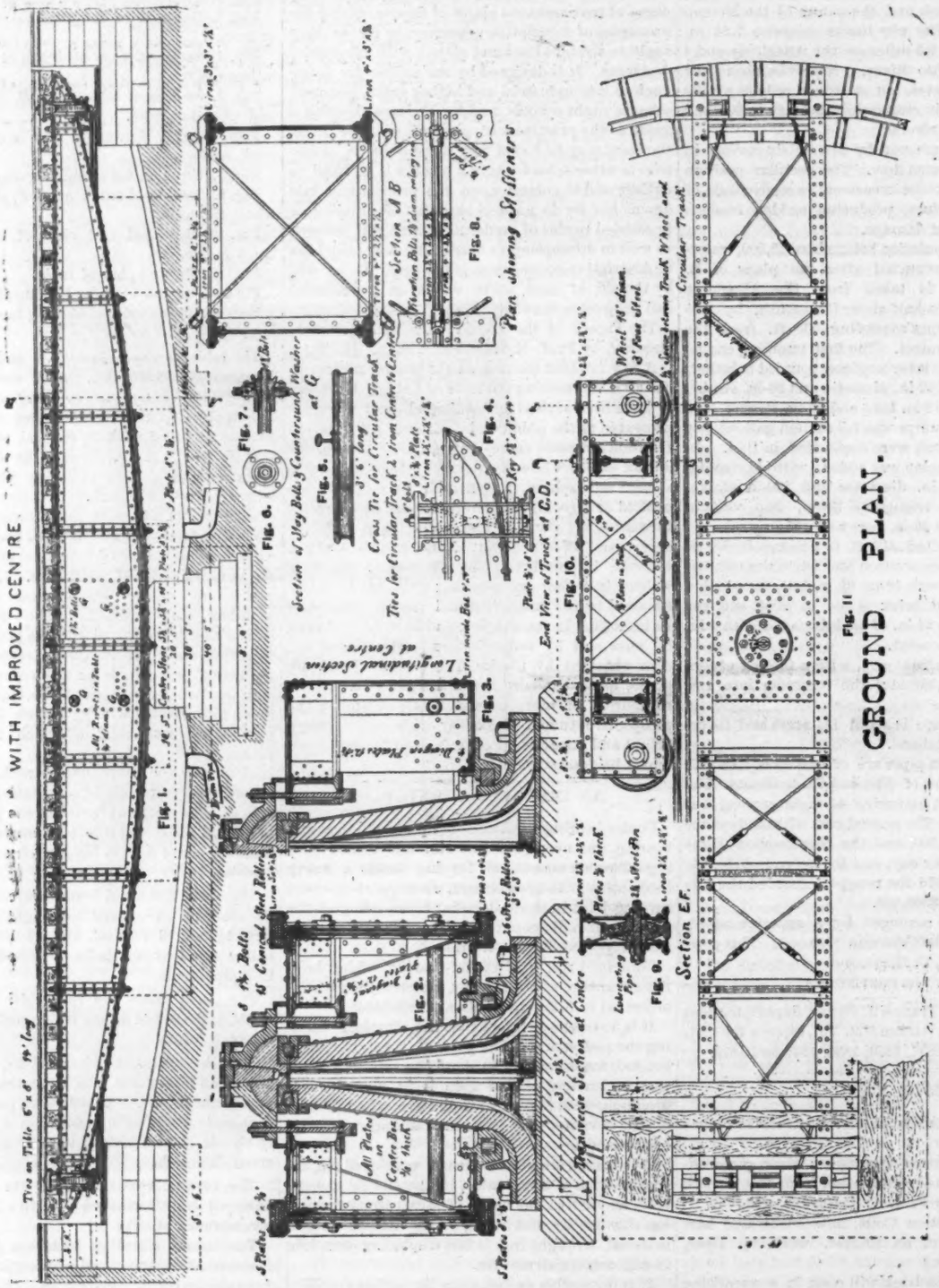
The lateral vibration bolts are ¾″ diameter, fastened at ends to chord plates with 1″ bolts, and furnished with ⅝″ sleeve nuts. (See Fig. 11.)

The four stay bolts pass through table and center-box transversely, and are provided with cast-iron flanges and washers bored and turned and braced apart with 2″ wrought-iron pipe. (See Figs. 2, 6 and 7.)

The center-box is six feet nine inches long, full depth of girder (less flanges), five feet one and one-quarter inches wide, and is composed of one top, one bottom, two side and two end plates ⅜″ thick; all inside corners except longitudinal, provided

with 4″×4″×12 lbs. angle iron, double riveted with ¾″ rivets, 6″ pitch.

Fig. 15 shows bracing inside center-box, I beams *CC*, 60½″ long × 12″ × 60 lbs., and beams *DDDD*, and *EE* of same weight as I beams *CC*, framed, riveted to framework in similar manner, wit 22h ¾″ rivets (and lies longitudinally with I beams *CC*, and transversely to table), except that said 22 rivets pass through top plate of center-box also. Diagonal braces *ii* are 15″ × ⅛″ × 119″, bent to



and riveted thereto with 16 splice plates *H*, and 128 ¾″ rivets.

Channel iron ring *F* is of equal depth with framework, riveted to washer-plate *B*, 30″ × 30″ × ⅝″, and is furnished with four cast-iron separators fitted to webs of I beam and channel iron. Washer plate *B* is then riveted to lower side of I beams *CC* and *EE* with 12 ¾″ rivets, through outer flanges only. Top plate 60½″ long × 30″ × ⅛″ is form shown in Fig. 15, riveted to bottom chord angles and inside box with 12 ¾″ rivets at each end, and passing over tops of I beams *DDDD*, under box-cover, and riveted thereto with 12 ¾″ rivets each. (See Fig. 15.)

The hole in center of bracing is 16″ diameter, and the bolt-holes are 2″ diameter. The bottom plate of center-box is provided with a casting, shouldered and riveted to its center, and having a turned, annular groove to receive a series of anti-friction rollers that roll loosely in said groove, and bear against the pedestal near its base. The axis of these rollers being vertical, they are subjected to only the lateral pressure requisite to keep the tables balanced in a horizontal plane, wholly escaping the vertical weight of the load that is borne by conical rollers having horizontal axis.

The pedestal is composed of eight 60 lbs. T rails, bent to the form shown in Fig. 2, their flanges outward incased in a wrought-iron plate ⅜″ thick, and riveted to the flanges with 96 ⅝″ rivets. One wrought-iron band at top, 3½″×1½″, also one wrought-iron band at base, 5″×1″, both bands

shrunk in place. The upper band draws the heads of T rails firmly together; the lower band is octagonal, and holds the ends of rails in place at base.

The casting for roller-bearing is riveted to flanges of T rails in same manner as ⅜″ wrought-iron casing.

At the time the pedestal is in the lathe to be turned on face for vertical roller bearing, the top of pedestal is also turned to receive roller box. This (roller box) contains 15 conical rollers, the whole made of crucible cast steel and as hard as can be turned in ordinary engine-lathe; these roll loosely between the steel plates, or housing, of the following dimensions:

Plates 15½″ diameter, 2¼″ thick, with 5½″ eye-beveled grooves nicely turned in plates to receive the rollers. The greatest diameter of grooves is 12⅝″, rollers 2 1/16″ diameter large end, 1 1/16″ diameter small end × 2¾″ long.

The advantages of the conical roller turning joint are well known to the art, and their broad wearing surface, accurate workmanship and hard material, is the cause of their durability and ease with which heavy loads can be turned upon them.

The above-described joint is surmounted by a "roller block" which with the cap makes a universal joint of the ball and socket form.

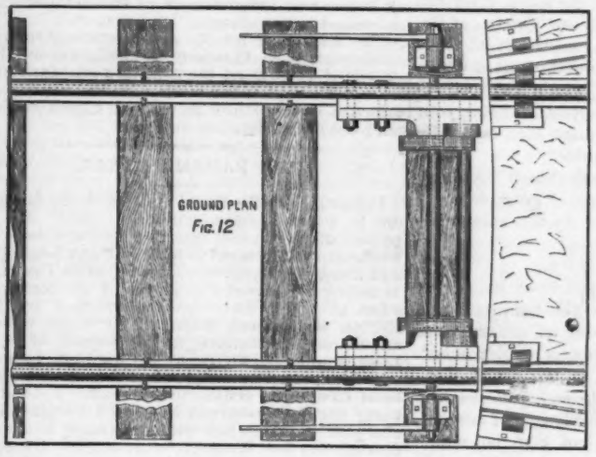
This is the point at which the table oscillates, being as high as practical, and enabling the table to be kept more readily in balance while the locomotive is upon it. The top of pedestal upon which the roller box rests is stationary, and retains the axis of *this* set of rollers in a horizontal plane and they receive the whole vertical pressure of the table and load.

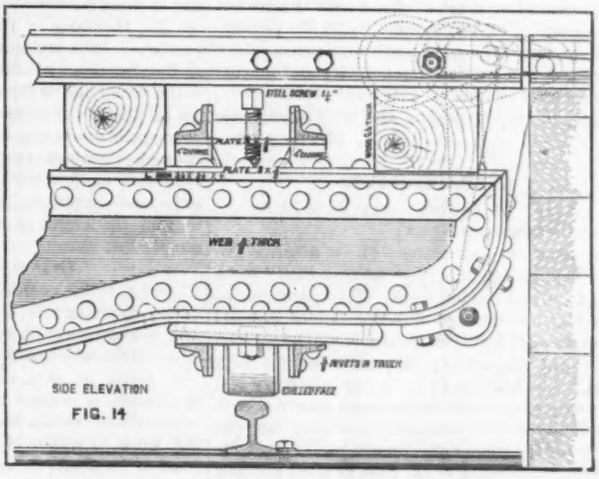
The ball and socket joint is essential to allow the table to adjust itself to any slight inequality of bearing for and supports of table The table is connected to the cap by eight 1¼″ bolts. The bolt holes in cap are ¼″ larger than bolts, to permit table to be "centered" when set up. Two small dowels, for which cap should be drilled at shop, should be put into top of table through cap, after table is "centered," that the center may not be lost in removing and replacing cap.

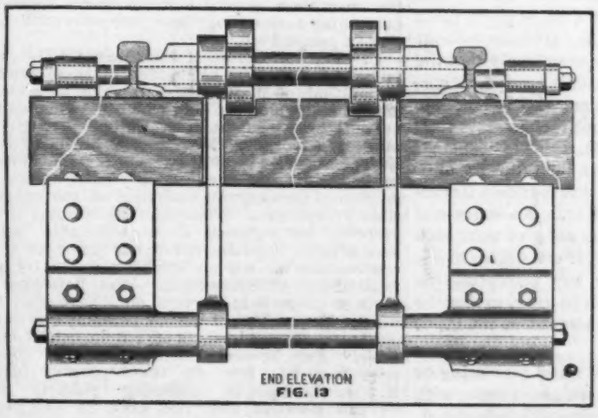
The vertical anti-friction rollers near base of pedestal serve to keep the table in a horizontal plane while turning, and the locking attachment shown in Figs. 12, 13 and 14 serves the same purpose while the load is passing on or off of table. The locking attachment is composed of one eccentric shaft, 2″ diameter, 10′ long, furnished with two eccentrics just inside of T rails on table of 1¾″ "throw" and 1½″ "face," and at its outer ends provided with two hand levers 30″ long. Bearings for this shaft, four in number, of cast iron; two are bolted to inside web of T rails on table, with two 1¼″ bolts each, and two lighter ones bolted to ties on table just inside of hand levers. The two eccentric yokes from above described shaft take hold of a second shaft 1¾″ diameter (steel) of suitable length to pass loosely between the web of T rails that form track; on outer ends of second shaft are two steel "shoes" bored out to slip on shaft, and shaped to fit inside of T rails. These "shoes" have a bearing surface of 12 square inches, that, when table is locked, rest on wrought-iron "head-chains" ¾″ thick that are let in flush with coping of stone wall that forms pit, and also receive the ends of rails in yard. (See Fig. 12.)

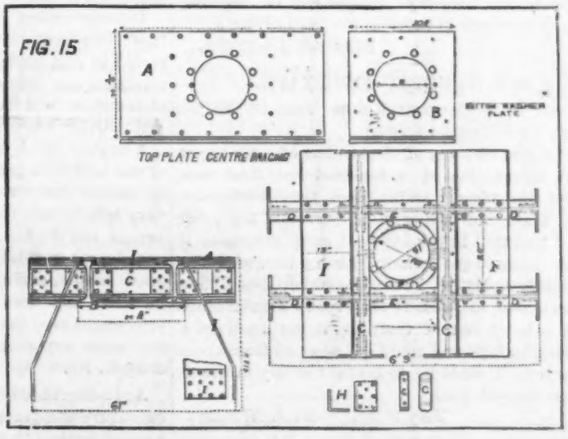
On above-described second shaft are suspended two stirrups, 3″ × 1⅛″, which take hold of a third shaft of steel 1¾″ diameter, which third shaft in turn passes through two cast-iron boxes. These are securely bolted with four 1″ steel bolts, each to outer ends of turn-table. (See Fig. 13.)

The two levers at outer ends of first described shaft lie down on cross ties of table when unlocked and on pit coping when locked, the "throw" of the eccentrics falling slightly below "dead center" when locked. The passing load has no tendency to unlock, but rather to keep attachment in locked position. (See Fig. 14.)









Locking attachments are placed on both ends of turntable, one end is only to be used, and the direction in which the locomotive is passing will determine which end is to be locked. The truck wheels and circular track are of well-known design, and serve on this table as safeguards only.

The set screws and wedges, shown with sectional view of track, Fig. 14, serve to adjust each truck wheel ¼″ vertically and independent of each other. The table is also adjustable at center 2¾″ in a vertical direction.

On ground plan, Fig. 11, four bolts are shown that serve to adjust trucks 3″ in longitudinal direction with table. They are ⅝″ diameter with enlarged ends that pass through truck frames, the other end being fastened to web of girder with ⅝″ bolt.

This table is designed for the heaviest class of consolidation engines.

The strains to which the iron is subjected are very moderate, the apparent excess of metal is necessary to insure rigidity of platform. It will be seen that this table herein illustrated and

described, is entirely *center-bearing, does not tip*, and although formed of *two* beams is so constructed as to be considered, and to act as *one beam*, and in addition to center adjustment has adjustable trucks. C. A. GREENLEAF.

CORRESPONDENCE.

MATHEMATICAL INSTRUMENTS.

EDITOR ENGINEERING NEWS:

What mathematical works would it be most desirable for one to use to refresh the memory in understanding and working out the formulæ in "Trautwine's Engineer's Pocket-Book?" I have not had occasion to look into such books for twenty-five years, but was a good mathematician at school and college, and studied trigonometry and surveying; now have charge of extensive water-works, and daily feel my ignorance, and wish to improve.

HYDRAULICS.

AVERAGE HAUL.

ON CONSTRUCTION, June 13, 1881.

EDITOR ENGINEERING NEWS:

Will some of your readers please describe the proper way to estimate the "*average haul*" for a railroad cut and embankment. The specifications state: "If the average distance hauled exceeds 300 feet, an additional compensation will be allowed of one cent per cubic yard per 100 feet for such excess." I would like to know the customary and proper way to estimate this average haul; also, if there is any work published that sets out the customs, of the proper allowances to be made for estimating unfinished work, such as stone cut and delivered for masonry, proportion of heading material to bench in tunnels, etc., and oblige a

RESIDENT ENGINEER.

ONE HUNDRED FEET TAPE.

OSWEGO, Kansas, June 13, 1881.

EDITOR ENGINEERING NEWS:

I wish you or some of the readers of your paper would inform me of a hundred-foot steel tape heavier and more durable than the Chesterman tape. I am now using a Chesterman tape, but have found that in the hands of most assistants it is very liable to get broken. Such a tape as Heller & Brightly advertise, I think, would do, but I have not been able to learn if they really manufacture it. I ordered one of their tapes, but received a Chesterman tape and could get no word from them afterward. I shall be thankful for any information on this subject.

Very truly, M. J. WELLS.

FORMULAS FOR TURNOUTS.

JACKSONVILLE, Fla., June 11, 1881.

EDITOR ENGINEERING NEWS:

In Mr. Johnson's formulæ for turnouts, which appear in your issue of June 4, there is one point which seems to have been overlooked.

Taking the first case given, when the turnout is a curve, tangent to the main line, the formula $4\sqrt{2R_0}$ would give the distance from the point of curve to the frog point. But the article referred to gives this as the distance from the *heel* of the switch to the frog point. This would place the heel of the switch at the P. C., and would only be possible in exceptional instances.

For example—suppose the turnout to be a 2° curve tangent to the main line, which in this case is a tangent. The distance from the P. C., to the frog point would be 164.1 ft. Now if we take the throw of the switch to be 0.42 ft. it is evident that with the heel located at the P. C., the switch rail must be of such a length that it will reach to a point on the curve where the tangential deflection is equal to the throw or 0.42 ft. With the curve in question this would require a switch rail about 49 ft. long. Besides this the rail would not be tangent to the curve, but would lie in the chord.

ENGINEER.

TRANSITION CURVES.

STEUBENVILLE, O., June 13, 1881.

EDITOR ENGINEERING NEWS:

Please give space in your paper for a few remarks that are called forth by the article on Transition Curves in your issue of May 28.

It seems to be believed by many that the cubical parabola is the best form for a connecting or transition curve, but we are sure that after a comparison it must be admitted that the spiral described by Mr. Holbrook in the *Railroad Gazette* of December 3, 1880, and now used on the P., C. & St. L. Ry., has many advantages, not the least of which is the simplicity of the tables, which makes all extra calculation unnecessary, notwithstanding your correspondent seems to intimate that especially constructed tables are undesirable.

By this method the only calculation necessary to be made in putting in a curve of given degree is to find the length of tangent by the simple formula

$$T = (R + x_0) \tan. \tfrac{1}{2} I + y_0,$$

X_0 and y_0 being quantities taken from the tables.

The instrument is set up at the point of curve, and the spiral run in by turning off deflections as found in the tables, until the circular part is reached. The latter is then run in in the usual way. Mr. Geddes is obliged to go through quite lengthy calculations, besides finding the length of tangent, the work of which he does not give, but which must at least take as many figures as indicated in the above formula.

The connecting curve should be of such length that the elevation of the outer rail at every point would be just sufficient for the curvature without elevating one side of the car so suddenly that the momentum will carry it sensibly beyond its normal position when the elevation ceases to increase.

A change of elevation of one inch in sixty feet, or one half-inch per rail length, seems to be enough to answer these requirements, and this for ordinary speeds calls for a spiral that increases its curvature one degree in sixty feet. An increase of one degree in thirty feet does not give quite such good results, and an increase of one degree in one hundred feet does not give any perceptible improvement over the one degree in sixty, so that the last is the one that has been adopted on the P., C. & St. L. Ry.

A six-degree curve with a spiral increasing its curvature one degree in ten feet, and a curve with a spiral increasing one degree in one hundred feet, may be located in such a way that they will not be three feet apart in any place, so that as far as topography is concerned, there is nothing to prevent using the same spiral on all curves, on new work at least, and the advantage of having uniformity is even greater than that of always using one table in running in the curve.

The method of locating a curve by ordinates from the tangent will generally be found troublesome if the curve is made long enough, the tangent in many cases running off of the road-bed, thus making it difficult to obtain the points accurately. In conclusion, it may be remarked that experience shows that a road where great speed is required cannot afford to be without the advantages of connecting curves so easily obtained.

GEO. W. KITTREDGE.

The Pennsylvania Railroad Company is about to build at the foot of Sussex street, Jersey City, a new two-story pier, 500 feet long and 150 wide, and covered in with corrugated iron. Double tracks for freight cars will be laid down the pier, alongside of which the largest Atlantic steamers can receive Western freight directly from the cars. The pier will cost $160,000.

MEXICAN NEWS.

Gen. Frisbie recently obtained from the Mexican Republic a railway concession deemed to be the most valuable yet granted. His route connects with the Southern Pacific & Rio Grande, and comes to Mexico City with branches to the Gulf and the Pacific.

The President of Mexico has inaugurated the first fifty miles to the Tula Central Railroad. The first train entered Cuantla, 140 kilometres from the City of Mexico. The Morelos Railroad was inaugurated on the same day.

President Gonzales, of Mexico, has granted a concession for a railroad from Piedras Negras to Topolovampo, with a subsidy of $5,000 per kilometer. Benjamin F. Butler, Wendell Phillips, F. O. Prince and Judge Abbott, of Massachusetts, are interested in the scheme.

The contractor for the construction of the railroad track from Laredo to Mexico along the Gulf deposited $50,000 on the 8th, as a guarantee that he would complete the work. He had already obtained a concession of $8,000 per kilometer to be paid out of importation duties.

THE PANAMA CANAL.

PANAMA, June 7.—Canal matters on the Isthmus are in an unchanged condition. Since the departure of Mr. Gaston Blanchet for Paris some six weeks ago affairs seem to have lost any intelligent and energetic direction. Dissatisfaction has crept in among the superior employés of the company, some of whom have been discharged by Mr. Reclus, the present manager. Of these, several remain on the Isthmus, at the request of M. de Lesseps, until the arrival of M. Charles de Lesseps, who is expected near the end of this month. Stations have been abandoned, brigades disbanded, many engineers returned home and workmen discharged. Sickness has come upon many and some deaths; very few, however, have occurred to deepen the dreary outlook before the men, poorly paid and but indifferently cared for, who have accepted the canal company's service on the Isthmus. In the meantime accounts from Paris represent everything as booming, and that adds to the disgust of people here.

The *Star and Herald* of June 6 says: "The cable on Saturday brought us another of those famous declarations of M. de Lesseps in which he seeks to deepen and widen the hold which the Panama Canal enterprise has taken in Europe through his masterly advocacy. That it will be accepted in Europe as gospel by multitudes is certain. People in the United States will look coldly upon it as another of the sanguine outbursts of the irrepressible Frenchman. With us on the Isthmus it will probably be regarded as unpardonable ignorance of what is passing before our very eyes if we confess that we see no sufficient reason for this fresh display of enthusiasm. Most flattering reports of progress in surveys, etc., have gone forward. The geological survey probably has developed some favorable facts of an important character. But however favorable these discoveries may be, how do they possibly justify M. de Lesseps in assuming publicly that he can perform this vast work in four years, when his original estimate was eight years, and only in another of his moments of enthusiasm did he declare the work would positively be finished in six years? If he proceeds in this style he will have the work done before it is commenced and, instead of saving 100,000,000 francs, would be able to divide a bonus among his shareholders. Frankly, we would like to see a little more accomplished on the Isthmus and less blowing in Paris about this business. Enthusiasm in Paris does not go a long way in Panama."—*N. Y. World.*

STREET CLEANING BILL FOR NEW YORK CITY.

An act to create a department of street cleaning in the City of New York, and to provide for the cleaning of the streets of said city; for the removal of snow and ice therefrom, and for the collection of ashes, garbage and street sweepings, and the disposal of the same.

Passed May 26, 1881; three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. In addition to the departments in the city of New York, provided for by chapter three hundred and thirty-five of the laws of eighteen hundred and seventy-three, together with the acts supplemental to and amendatory thereof, there is hereby created a department of street cleaning which shall have exclusive charge of the cleaning of

streets, and the removal of ashes and garbage in said city. The head of said department shall be called the commissioner of street cleaning. He shall be appointed by the Mayor, with the approval of the Board of Health, but if after three ballots the said board shall fail to confirm or reject, by a majority vote, any person nominated by the Mayor, two affirmative votes shall be sufficient for his confirmation. He shall be subject to removal by the Mayor whenever the Mayor shall certify that in his judgment such removal is required in the public interest, but, with the approval of the Board of Health; but if, after three ballots, the said Board of Health shall fail to approve of such removal, then two affirmative votes of said Board of Health shall be sufficient for his removal. He shall be paid a salary of six thousand dollars per annum, payable monthly, and shall hold his office for six years, and until his successor be appointed, unless sooner removed. The provisions of section twenty-five of the aforesaid chapter shall not be applicable to the office of commissioner hereby created.

Sec. 2. Said commissioner shall have power and authority, and is hereby charged with the duty of causing the streets of said city, which shall include all the public avenues, streets, lanes, alleys, places, wharves, piers, and heads of slips therein, except such as are within any park under the control and management of the Department of Public Parks, to be thoroughly cleaned and kept clean at all times, and of removing from said city or otherwise disposing of, as often as the public health and use of the streets may require, all street sweepings, ashes and garbage, and of removing new fallen snow from leading thoroughfares and such other streets and avenues as may be found practicable. The expenses of said department of street cleaning shall be provided for in the same manner as the expenses of other departments under the said chapter three hundred and thirty-five of the laws of eighteen hundred and seventy-three, and the acts supplemental to and amendatory thereof, but in no case shall the amount expended by said commissioner exceed the amount appropriated for his said department by the Board of Estimate and Apportionment. Said commissioner shall file with the Comptroller of said city, monthly, a statement under oath, showing the number and the names of all persons employed by him during the preceding month, and the amount paid to each of them, and the particular kind of work in which each of them shall have been employed during such month.

Sec. 3. Said commissioner shall have power to engage, and in his discretion discharge from time to time, all such clerks, laborers and other employés, and to fix their compensation, as shall be necessary and proper in executing the duties hereby imposed upon him; and may make and from time to time alter rules and regulations for their government. But the compensation and wages of such clerks, laborers and other employés shall not exceed the current market rate paid for similar services in private business. The said commissioner shall also have power to hire or purchase for his use as such commissioner, at current market prices, horses, carts, steam-tugs, scows, boats, vessels, machines, tools, and other property required for the economical and effectual performance of his said duty; or contract for the construction of any such tugs, scows, boats, vessels, or machines; the title to which property so purchased shall be in the Mayor, Aldermen, and commonalty of the city of New York. All such hirings or purchases or contracts, however, exceeding one thousand dollars in amount at any one hiring or purchase, shall be by contract, let to the lowest bidder therefor, founded on sealed proposals or bids, made in compliance with public notice advertised in the *City Record*; such notice to be published at least ten days prior to the opening of such proposals or bids. Whenever the said commissioner shall deem it necessary, he shall and he is hereby authorized so to do, sell at public auction any plant, material, horses, carts, scows or other property used in any way in connection with the work of cleaning the streets of the city of New York. The said commissioner is hereby authorized to hire or lease suitable and sufficient offices for the transaction of the business under his charge, and also such stables and other buildings as may from time to time be necessary.

Sec. 4. The department, bureau, or city officer, authority or authorities, which shall from time to time have the management and control of the public docks, piers and slips of said city, shall designate and set apart for the use of said commissioner suitable and sufficient slips, piers and berths in slips, located as the said commissioner may require, and such as shall be convenient and necessary for his use in executing the duty hereby imposed upon him, excepting slips, docks and piers on th East River, set apart for the use of canal boats. The said commissioner may, with the approval in writing of the Board of Estimate and Apportionment, lease piers, slips or wharves for the necessary purpose of the duties by this act conferred, whenever suitable piers, slips or wharves owned by or under the control of the city cannt be obtained, or are not set apart and designated, as in this section provided.

Sec. 5. In the work of street sweeping and cleaning, and in the collection and removal of street sweepings, ashes and garbage, the men may be provided with some distinctive dress or portion thereof, or some badge designated by said commissioner, to be so worn that they shall be easily recognized as employés of the department.

Sec. 6. Said commissioner may let out special contracts for periods not exceeding three years for the work of street sweeping and cleaning, or for the collection of ashes and garbage, or some part thereof, in particular districts, to be designated for that purpose by the said commissioner, and the terms and conditions of which contracts shall have been first approved by the Board of Estimate and Apportionment, provided that such contracts shall in all cases provide for their termination on ten days' notice, by the commissioner, with the approval of the Mayor.

Sec. 7. Said commissioner shall have power to enter into contracts with responsible persons and parties for the final disposition for periods not exceeding five years, of all or any part of the said street sweepings, ashes or garbage when collected, provided always that such contracts shall be approved, both as to terms and conditions, by the Board of Estimate and Apportionment of said city. All contracts shall be entered into on behalf of the city by the commissioner, with adequate security. He shall advertise for proposals in such newspapers in the city as he may designate, not exceeding three in number, for ten days, to perform the work in such form and manner and on such terms and conditions as he may prescribe. Such proposals may be for the performance of all or such parts or portions of the work as he shall require. Each proposal must be accompanied by a certified check on a solvent banking incorporation in said city payable to the order of the Comptroller for five per centum of the amount for which the work bid for is proposed in any one year to be performed. From the proposals so received he may select the bid or bids, the acceptance of which will, in his judgment, best secure the efficient performance of the work, or he may reject any or all of said bids. On the acceptance of any bid by him the checks of the unaccepted bidders shall be returned to them, and upon the execution of the contract the check of the accepted bidder shall be returned to him. The sureties upon all contracts hereby authorized shall be approved by the Comptroller, and all contracts and bonds securing the same shall be approved as to form by the Counsel to the Corporation.

Sec. 8. Upon the organization of the department hereby created and notice thereof from said commissioner to the Police Department of the said city, all books, papers, records, property, leases, moneys, accounts, claims, and things of every kind and description belonging to or in the custody of the said Police Department, and used by the existing Bureau of Street Cleaning in the work of cleaning the streets in the said city, or of the removal of ashes and garbage, shall be transferred by the said Police Department to the department of street cleaning herein created, and until such transfer takes place the said Police Department shall continue the work of street cleaning and removal of ashes and garbage as now provided by law. At the same time that the above mentioned transfer takes place the Comptroller of the said city shall transfer to the credit of the department of street cleaning any unexpended balances for street cleaning purposes that may be at that time standing to the credit of the Police Department in excess of liabilities incurred by said Police Department for street cleaning.

Sec. 9. The said commissioner of street cleaning, with the approval of the Mayor, may provide for cremating or burning street refuse or garbage, and may, through the Commissioners of the Sinking Fund, lease or purchase land for the erection thereon of suitable crematories or furnaces.

Sec. 10. It shall be lawful for the commissioner of street cleaning to cause to be dumped snow and ice from the ends, or near the ends of any piers into the waters of the East and North or Hudson rivers. But no dead animals, carrion, street sweepings, garbage, or any putrid, offensive, decaying or refuse vegetables or animal matter, shall be deposited in violation of chapter four hundred and sixty-three of the laws of one thousand eight hundred and eighty.

Sec. 11. Nothing in this act shall be construed as affecting in any way the powers of the Board of Health of the Health Department of the said city; but the said Board of Health shall cause to be enforced the provisions of its sanitary code, requiring that separate receptacles be provided for ashes and rubbish and for garbage and liquid substances, and forbidding that the same be placed or kept in the same receptacle, and requiring the streets and sidewalks to be kept free from incumbrance by such receptacles except at such times as may be designated by the commissioner of street cleaning for the collection of their contents; and for violation of any of the said provisions of said code, both the owners and occupants of all houses in the city of New York shall be severally responsible and subject to the penalties and prosecutions imposed by the said code, and all other provisions of said code and of the city ordinances relative to the cleanliness of the streets; and the said Board of Health is empowered to institute prosecutions and suits for penalties for the violation of any such provisions in the name of the mayor, aldermen, and commonalty of the city of New York.

Sec. 12. The several provisions of chapter six hundred and seventy-seven of the laws of eighteen hundred and seventy-two, and of section sixty-seven of chapter three hundred and thirty-five of the laws of eighteen hundred and seventy-three, and all other acts and parts of acts inconsistent herewith are hereby repealed.

Sec. 13. Upon requisition of the commissioner of street cleaning setting forth the necessity for any such appropriation, and the specific purposes to which it is to be applied, the Board of Estimate and Apportionment may, at its discretion, at any time before the confirmation of the tax levy in the year one thousand eight hundred and eighty-one, appropriate money for the purpose of constructing or purchasing seagoing vessels to be used in conveying street sweepings, ashes, and garbage to sea, or for the purpose of cleaning the streets and removing snow and ice, or for building crematories or furnaces for burning street refuse or leasing or purchasing lands therefor, but the moneys so appropriated shall not in the aggregate exceed three hundred and fifty thousand dollars; and any requisition for money for the purpose of purchasing such vessels shall be accompanied by plans and specifications of such vessels. Any appropriation or appropriations so made by the Board of Estimate and Apportionment shall be added to the amount appropriated in the final estimate for the year one thousand eight hundred and eighty-one, and revenue bonds shall be issued therefor in like manner as for the expenditures of the city government during the said year, and the amount so appropriated shall be added to the tax levy for the year one thousand eight hundred and eighty-one.

Sec. 14. This act shall take effect immediately.

COMMANDER GORRINGE ON CLEANING THE STREETS OF NEW YORK.

[From The Nation, May 12, 1881.]

The essential feature of the organization for cleaning and removing the refuse from the city would be the division of the thoroughfares into sections of suitable lengths, and the assignment of certain men and apparatus to each section, for the perfect cleanliness of which the individuals thus assigned would be held responsible. This organization is identical with that adopted on all vessels of war, where each officer and man has a definite duty assigned him for every possible contingency that experience has suggested, from engaging an enemy to abandoning the vessel in the event of collision or other catastrophe. For this purpose there is made a "station-bill," containing the name of each man and the rôle allotted him in all the different evolutions, and to each one is given a slip of paper on which his duties are clearly set forth. A "station-bill" for street-cleaning would be a much more simple affair, as there would be but one or two evolutions, if the term is applicable; whereas, on a man-of-war there are an indefinite number, depending on the class of vessel, and the qualifications of each man for the varying duties required of him must be carefully studied and averaged, as it were, in order to get his best out of him.

It may be said that such an organization would be impracticable in any civil service, and would require some form of military discipline to make it efficient. The answer to this lies in the fact that on a vessel of war the men are enlisted for a definite period, and, good or bad, they must be retained and made the most of; whereas, in the matter of cleaning the streets, the men employed may be re-

tained or discharged at the pleasure of the head of the department, if only it can be absolutely divorced from what is termed "politics." No possible organization can succeed unless this divorce is made perfect. An employé, confident that his position was secure as long as the work assigned him was properly executed, and that no influence under heaven could secure his retention unless it was properly executed, would be sure to do the work faithfully and well, for it does not require any mental effort.

The public themselves would be the *inspectors*. A complaint from any quarter, of any nature, would call for an examination of the section, and if it were found that the individuals assigned to it had not performed the work, dismissal should follow promptly. But, in order to relieve the public from what might to some be a disagreeable duty, the sections should be grouped into divisions, not exceeding twenty, just large enough to enable the inspector of each to walk all over it in a working day. And in order to prevent collusion between the inspectors and other employés the division that each was to inspect should be changed each day and assigned to them by lot in the morning at the central office, where they should be required to report the result of the previous day's inspection on regular forms.

The length of each section would have to be determined by circumstances—such as character of buildings, width of street, traffic, and distance from place of deposit. By actual experiment it is safe to assume that the *average* length of each section would be about three thousand yards; some would be much less and some much more. Assuming that there are three hundred and fifty miles of streets to be cleaned daily, this would give two hundred and eight sections, to each of which there would be assigned three men, two horse-carts, and one hand-cart. One of the men would be assigned to sweeping, and be required to collect and remove the material that could be used as a fertilizer to a certain spot, there to be disposed of or further removed by the horse-carts as circumstances might dictate. The sweeper would have the hand-cart. The two other men and horse-carts would also be assigned to removing the ashes and garbage. The carts would have compartments in each so as as to keep these substances separate. The barrels in which ashes and garbage are now deposited *mixed* should be abolished and suitable receptacles substituted for them, marked with the words *ashes* or *garbage*, so as to induce the depositors from buildings to comply with the law and keep them separate. Such receptacles are actually in use in several places in the city, mounted on rollers for facility of transfer. By a simple device they might be made easy to empty into the cart by the driver alone.

The watering of streets, now the exception and not the rule of the present organization, is a matter of grave importance, not only to allay the dust but to diminish the radiation from the heated pavements in summer. Assuming that there are three hundred miles of streets to be watered, and that the rate would be only one mile an hour, it would require thirty watering-tanks and drivers and sixty horses to perform this work. By constructing these tanks of iron with flues passing through them, and substituting for the sprinkler, used in summer for watering, a *simple furnace for melting the snow in winter*, it might be possible to save the labor and expense of transporting it to the river. Snow is from nine to eleven times the bulk of water. The men who were sweepers when the snow was not on the ground could be reinforced by temporary labor, always available in winter, to collect the snow and shovel it into the water-tank, where it would be melted, and when so melted the water could be run into the nearest trap or man-hole and pass off through the sewers. A very small supply of fuel would be necessary to raise the temperature of the tank above the freezing point, and this could be carried in the hand-cart. If this plan of disposing of the snow should be found effective, an extra number of watering-carts should be kept on hand ready for winter use as melting-tanks. Thus far no more economical and effective method has been suggested of disposing of one of the most embarrassing conditions of winter street-cleaning.

It cannot be disputed that of the refuse collected from a city at least ninety per cent. has a commercial value. Instead of throwing this equivalent of money into the bay and its adjacent waters, to return with the flood-tide and form shoals and breed disease, it should be sold or disposed of for an equivalent in labor or material. The sweepings should be dumped into box-cars on railway barges, which should be towed to the different railway termini and the cars run out on the roads to suitable points for distribution to farmers. It is believed that the value of the sweepings is ample to defray the expenses of removal from the wharves, and there is every reason to believe that contractors could be found ready to undertake the removal from the wharves without cost to the city, and willing to bind themselves to provide the cars and barges. It is probable that in time they might even pay for the privilege of doing this work.

The ashes should be used for filling in shoal ground or leveling hollows. In the beginning it would be well for the city to bulkhead some shoal in the harbor, leaving an entrance for the scow to be floated in at high water, allowed to ground, and unloaded at low water. This would hardly be necessary, for there are many places where the owners of water-front property would pay something for the ashes regularly dumped, and be willing to build the bulkhead, with the understanding that they should have the ashes.

The garbage should be burned. Apparatus for this purpose is easily designed and might be placed on the scows for removing ashes, or at certain points on the outskirts of the city. Although garbage is eagerly eaten by hogs, and may be utilized for this purpose, it is a question that can only be determined by actual experiment whether it would be the more economical to have furnaces to burn it or hogs to eat it; and whether or not the hogs fed on garbage, always more or less in a state of fermentation and decay, are fit for human food. Under no circumstances should the garbage be mixed with sweepings for fertilizing. Decay must take place before it can become a fertilizer, and in the progress of the decay of the animal and vegetable matter of which garbage is composed diseases are generated.

All business parts of the city should be swept at night. Sweeping-machines should be used, wherever possible, by grouping the sections and assigning one machine in lieu of a certain number of sweepers, having enough sweepers, however, to remove the dirt. Owing to the ruts and holes so common in our streets, and the prevailing kinds of pavement, sweeping-machines are not available for general use. The decaying matter in the ruts and holes and between the stones and blocks that form the pavements is passed over by the machine, but would be removed by hand-brooms.

It cannot be expected that such a radical change of system would be reduced to its most economical working immediately, and that the length of sections and other duties assigned to individuals would be the best at first. But these matters are easily adjusted after a few weeks of trial. It is probable that three horse-carts would be found ample to remove everything from two sections, instead of two for each section, after the streets have been once thoroughly cleaned.

This organization would require an executive force, including inspectors, of about forty persons, at an aggregate annual salary of about $55,000; a mechanical force of about thirty persons, with an aggregate annual pay of about $25,000; a laboring force averaging not more than six hundred per day, including the extra men employed for snow and taking account of the grouping of sections for sweeping-machines, with an annual pay of $250,000 (it may be well to estimate this item at $300,000), and 750 horses, the cost of whose maintenance would be about $30,000 per year, including stable-room. If this aggregate sum of $410,000 were increased to $600,000, so as to include all possible contingencies for fuel and tools and material, it would seem ample to cover the cost of cleaning and keeping clean and removing the refuse, *after an adequate plant had been provided*. If the result were a clean city with a greater expenditure, there would be no reason for complaint when comparison was made with the past condition and expenditure.

It would be possible to have the city cleaned by contract by enacting a law that should give to any property holder or lessee the right to have the street swept and the refuse removed at the expense of the contractor if he neglected to do it, the bills for doing the work to be paid out of the amount of his contract by the accounting officers of the city after proper investigation. Unquestionably there are responsible men ready to bid for the work of street-cleaning; and there is hardly a doubt that these men could do the same work for less money than it could be done under any city organization, chiefly owing to the indisputable fact that city, State and national employés of the lower grades are disposed to do as little work as possible for the pay received, and habitually do less than they would be obliged to do if employed by contractors. Herein lies the secret of the universal seeking for public office in almost every civilized country.

OUTLINE OF THE RECTANGULAR SYSTEM OF SURVEYING.

FROM THE REPORT OF HON. JOSEPH S. WILSON, FORMERLY COMMISSIONER GENERAL LAND OFFICE.*

Immediately after the close of the war of independence, the illustrious Statesmen of that age, foreseeing the inestimable value, present and prospective, to this republic of the national territory, and the importance of early opening the way for its settlement, and for a gradual and progressive transfer to individual ownership under well-defined principles, took measures to these ends, as shown by the journals of the Continental Congress, by reporting, on the 7th of May, 1784, "An Ordinance for Ascertaining the Mode of Locating and Disposing of Lands in the Western Territory."

That ordinance was considered, discussed and amended, until the expiration of a year from its introduction, when it was finally passed May 7, 1785. It had no precedent in the theory or practice of any pre-existing government. It was the result not only of the highest order of statesmanship, but exhibited a profound knowledge of engineering science in minute details.

The ordinance made provision for surveying and disposing of the public domain, as well as for donations in the cause of education and for military services. As the extension of the public surveys is an essential prerequisite to the consummation of titles, under numerous acts of legislation, the following is submitted as an outline of the rectangular system of survey, which system has progressed gradually to its present extent, stretching from the Atlantic to the Pacific Ocean, and from 49° north latitude to the Rio Grande del Norte, excepting the six New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Tennessee, Kentucky and Texas, the United States not being the owner of public lands in any of these political divisions. During a period of eighty-four years this system has answered the wants of the people, securing ready and unerring land marks, the permanency of which, as well as the feasibility of their restoration, where destroyed by time or accident, has obviated litigation respecting titles to tracts thus defined.

The system consists of initial points, or the points of intersection of principal base lines, surveyed, measured, and marked on a true parallel of latitude, with principal surveying meridians. In establishing the principal lines from the points of intersection to the four cardinal points of the compass, surveyors mark the corners for quarter-sections, sections and townships, at forty, eighty and four hundred and eighty chains.

From the base lines, which are run on the parallel of latitude, townships count north and south, and from the principal surveying meridian, ranges proceed east and west. At the distance of twenty-four miles, or every fourth township lying north of the principal base, and at every thirty miles, or five townships south of the base, standard or correction parallels are established, which in turn becomes bases for surveys situated immediately north or south of them.

Next, guide or auxiliary meridians are surveyed at every eight ranges, or forty-eight miles east and west of the principal surveying meridian, which starting in the first instance from the principal base and the first standard parallel south, run due north to the intersection of the first correction parallel north and the principal base, thus forming parallelograms of twenty-four by forty-eight miles north of the principal base, and thirty by forty-eight miles south thereof, embraced by the principal meridian, principal base, first correction parallels north and south of the principal base, and first guide meridian east and west of the principal meridian. These principal lines constitute a frame-work of the rectangular system. Each of the aforesaid parallelograms, as well as others situated further north and south, east and west of the principal base and principal meridian, are established on the face of the earth at like distances from those lines or from auxiliary bases and guide meridians. This process divides the land States and Territories into regular and well-defined bodies of land, any one of which, no matter how remote it may be from the principal base and meridian, can be divided into townships of six miles square each, containing, as near as may be, 23,040 acres. The townships are square, each subdivided into thirty-six sections of a mile square, and containing, as near as possible, 640 acres.

Although the laws governing the public surveys do not require the actual subdivision of sections

* Extract from Public Land Laws, by J. Dunn.

by running and marking lines within them, yet they point out the method by which purchasers may have, at their own expense, subdivided and marked in the field each section into quarter-sections, or one hundred and sixty acres, and these into quarter-quarter sections, or forty acres; that service being generally performed by county surveyors in accordance with the original field notes of surveys executed by United States surveyors. This rectangular method, according to the true meridian, and noting the variation of the magnetic needle, has the advantage of all others in that it is simple, economical, easy of reference in the identification of localities of the most minute subdivisions, by merely designating principal meridian and base line, township, range and section. In addition to these facilities, it affords a convenient method of ascertaining distances between various points, towns and cities without resorting to the scale of maps, in simply counting squares of townships delineated on the government maps, and allowing to each six lineal miles.

But its chief advantage consists in the facility it furnishes to purchasers to acquire titles either to minute or extensive tracts. It supersedes intricate descriptions in patents, which are necessary, according to geometrical systems, depending on numerous courses and distances for the ascertainment of boundaries resting on corners and sundry variations of the magnetic needle.

The establishment of the rectangular method of survey, and rapid sale of public land in different States and Territories, necessitated the institution of twenty-three principal meridians, which govern the surveys of the public domain.

Ohio public surveys are controlled by several initial points, and by the first principal meridian coincident with the common boundary between that State and Indiana. Indiana surveys are referable to the second principal meridian.

Illinois surveys are governed by the second, third and fourth principal meridians.

Wisconsin surveys are controlled by the fourth principal meridian.

Minnesota public lands are referable to the fourth and fifth principal meridians.

Dakota surveys are regulated by the fifth and sixth principal meridians.

Iowa, Missouri and Arkansas by the fifth principal meridian.

Kansas, Nebraska, and the greater part of Colorado, by the sixth principal meridian.

Michigan surveys by the Michigan meridian.

Florida surveys by the Tallahassee meridian.

Alabama surveys by the Huntsville and St. Stephen's meridians.

Mississippi surveys are controlled by the St. Stephen's, the Choctaw and the Washington meridians.

Louisiana surveys are regulated east of the Mississippi River by the St. Helena meridian, and on the west by the Louisiana meridian.

New Mexico surveys are governed by the New Mexico meridian.

Arizona surveys depend on the Gila and Salt River meridian.

Utah surveys depend on the Great Salt Lake meridian.

Nevada surveys are goverened by the Mount Diablo meridian.

Idaho surveys by the Boise meridian.

Montana surveys by the Montana meridian.

California surveys depend on the Mount Diablo, the St. Bernardino, and the Humboldt meridians.

Oregon and Washington surveys are governed by the Williamette meridian.

As the law requires the lines of the public surveys to be regulated by the true meridian, and that the *township shall be six miles square*, recourse has been had to standard parallels and guide meridians to arrest within parallelograms the convergency and divergency of the meridians, resulting in a substantial adherence to the statutory enactments.

THE PLUMBING INSPECTION LAW.

The plumbers of this city and Brooklyn are considerably excited over the passage of a bill by the Legislature, looking toward a more perfect system in regard to plumbing. The bill was introduced Jan. 11, and was recently passed by both houses and signed by the Governor. It provides that every master or journeyman plumber in this city and Brooklyn shall register his name with the Health Department of his city, under certain rules and regulations to be prescribed by the department on or before March 1, 1882. It empowers the health boards to receive and place on file plans and drawings of the plumbing and drainage of all buildings, and directs the Board of Apportionment to add six thousand dollars to the apportionment of the Health Board of 1881. The bill makes a violation of any of its provisions a misdemeanor. This plan, like the bill itself, refers only to New York, and leaves the question of repairs to the plumbers and owners of houses. When work has been completed the plumber is to notify the Board of the fact, so that an inspector may be sent to examine it. Plumbers are forbidden to cover the work from view before such inspection. All materials are to be of good quality and free from all defects, and all plumbing is to be so placed as to be easily inspected. Dr. Janeway, of the Board of Health, recently said to a reporter of the *World:* "The Board of Health has as yet received no official notice of the passage of the bill. We shall, therefore, not be able to begin to carry out its provisions for a week or two. Such a bill has long been needed. The public has no notion how much sickness is caused not only among the poorer classes alone, but in all classes, by botchy and imperfect plumbing. Sewer gas is responsible for a vast number of deaths every year, and sewer gas could be kept out of the houses of poor and rich alike if the work of the plumbers were under strict regulation. The board has no intention of tyrannizing over the plumbers or the public, all we want is to insure health, and to do that a stop must be put to the slipshod plumbing work that is being put into too many of our buildings—both tenements and private houses. Before we draw up our final plans we will consult the best plumbers and sanitary engineers in the city. There will be no doctors on the examining board, and there will be no fees. I do not think the public are aware of the large number of houses that are building in this city on speculation. The aim and object of the builders of these structures is to sell them as soon as they can, and they do not care what sort of material is used. Some of the iron pipes are slipped into each other, and in some the joints are filled with putty instead of lead or cement. As the law now stands, the Board of Health has jurisdiction only over houses occupied by over three families. Thus these unprincipled builders can speculate with impunity."

In speaking of this subject, the *Sanitary Engineer* remarks: "Under the plumbers' bill the Board of Health now have the power to insist on proper plumbing in private houses, and all buildings other than tenement houses, and they can compel by law the obeying of their orders. Hitherto they have never been able to do so, and when a landlord resisted there was no law to compel him to act. Now, thanks to the plumbers' bill, that point is gained. And it was just this important feature of the law that induced certain landlords to make opposition to the measure during the winter, alleging that it was got up to harass landlords, and make work for plumbers. The later opposition, therefore, of the plumbers, seems an anomaly."

NOTES.

AN OBSCURE NATURAL BRIDGE.

In Walker County, Albany, is a natural bridge said to rival that of Virginia. It is in the sandstone called millstone grit, which underlies the coal formation. It spans about 120 feet and its height is about 70 feet. A smaller bridge connects it with the bluff beyond. The lines of stratification of the sandstone give the structure the appearance of having been artificially built up with massive blocks. It is in the midst of a region of wild and romantic beauty, high escarpments of the same sandstone being seen standing out in the face of the hills around.

MAGNETIC NEEDLE.

About three weeks ago the engineering class of the University tested the variation of the compass at the United States Meridian Line in the State House yard.

By one compass the variation of the needle at the south station differed 40 minutes from the variation of the needle at the north station. The second compass made a variation of 41 min.

If any surveyor uses the variation of the needle as determined from the aforesaid south station, the lines of his survey are liable to differ from the true line by more than thirty feet in any half mile. Land owners are cautioned in this matter. Litigation will grow out of surveying based on errors so large.—*R. W. McFarland in Ohio State Journal.*

ELECTRIC MOTORS.

The statement that it is intended to run trains into the St. Gothard tunnel by electricity is interesting in connection with the electric railway at Berlin. This is not an experiment, but a real business venture. The road runs out two miles to a suburb, and already gives promise of success. The State authorities have limited it to nine English miles an hour. Though decided to be legally a tram-car, the vehicle used by the company is a kind of electrical carriage. It is capable of making the two miles in five minutes. The interest in electricity as a motive power seems greater in Europe than in this country, and if we are to have the credit of making it really useful in that direction, from appearances, our new Edison must quickly show himself. Alexander Siemens, in a recent lecture before the Society of Arts, in London, expressed himself as most hopeful of the speedy solution of the problem of dividing and using electric currents for mechanical purposes. He thinks already small electric engines with a central generator can be made more economical than steam.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

Speaking of water-works reminds us that the contract for the ten millions of gallons per day compound-pumping engines for the water-works for St. Petersburg, Russia, has been awarded to the Geo. F. Blake Manufacturing Company, of Boston, who are the present proprietors of the Knowles Steam Pumping Works also.

The borough of McKeesport, Pa., intends building water-works this summer. It proposes laying about 9 miles of cast-iron water pipes, and building a reservoir at an elevation of 310 feet above low water, with a capacity of five million gallons, together with pump and boiler-house, etc. The water will be taken from the Youghiogheny River, at about one mile above its mouth. Messrs. Hatch & Taylor have been appointed engineers of the work.

The water mains at New London, Conn., are being extended on Ocean avenue a distance of 3,500 ft. The pipe, part of which is 10-in. and part 6-in., is of wrought iron, lined with cement. The shells of the 10-in. are of No. 14, and of the 6-in. No. 18 gauge, with spiral riveted seams, made by the Abendroth & Root Manufacturing Company, of New York. Before lining, the shells are treated to a bath of asphalt, making them water-tight. Portland cement in part is used for the joints and Rosendale cement and sand in equal parts for the coating and lining. Seven hydrants of the Boston Meter Company's make will be set. The entire work is being done by the day under the direction of Superintendent W. H. Richards.

The water ordinance recently introduced before the Common Council of Madison, Wisconsin, provides for the establishment of the Madison Water Company for the term of 20 years for the purpose of supplying the city with water. The system will be that of direct pumping into the mains, by the quadruplex compound condensing pumps of the Holly Company, which shall have a capacity of not less than two million gallons in 24 hours, in addition to an auxiliary or reserve high-pressure pump of same size. Section 5 of the ordinance states that there shall not be less than eleven and a half miles of mains and pipes for the distribution of water, to be located by the Council in accordance with a plan submitted. The mains shall be of standard weight and strenght, and of such size as to secure an easy flow of water through the entire system, and must be covered by at least five feet of earth. The company shall erect 110 double nozzle anti-freezing fire hydrants, to be located as directed by the council, and for which the city will pay $8,250 annually. For all extensions of mains which the city may order, the company shall erect not less than ten fire hydrants to the mile, for which the city will pay an annual rental of $50. The works must have the capacity of discharging six fire streams through one-inch nozzles from any six hydrants in the highest points in the city, through 50 feet of two and one-half inch hose, to a height of 100 ft., or ten streams 80 feet high. The city may purchase the works, the price to be determined by three appraisers, one appointed by the city, another by the company, and the two choosing a third. The works must be commenced on or before July 1, 1881, and completed in six months thereafter.

ELECTRICITY.

Thomas A. Edison, the electrician, has purchased the factory at East Newark, New Jersey, which belonged to the Peters Manufacturing Company. He will manufacture there his electric lights, and will, it is said, give employment at the start to 1,000 men.

The sudden failure of the electric lights which illuminate a part of Broadway was one of the incidents of the rain-storm of Tuesday night. All the lights on one of the circuits supplied by the Brush Company went out about 12 o'clock, and the street was in darkness for more than an hour. Mr. C. M. Rowley, the general manager of the Brush Illuminating Company, said yesterday to a *Tribune* reporter:

"It took us some time to find out what the difficulty was, but it was remedied within an hour, and will not occur again. The posts and hoods of our lights are of iron, and of course perfect conductors of electricity if once a current touches them. The heavy rainfall carried a rush of water into the hoods, probably through the chimneys or the holes through which the insulators

enter the top, and the water established a connection between the wire and the iron of the hood, so that the electricity was attracted down to the ground instead of to the carbon points. The defects have been repaired, and no more iron posts will be put up, so that a recurrence of the failure need not be feared."—*Tribune, June 9.*

STREETS, DRAINAGE, ETC.

The Board of Public Works of the city of New Haven, Conn., have awarded contracts for the construction of sewers, as follows: In Clark street, from State street to Orange street, and in Eld street, from State street to Orange street, to Lawrence O'Brien. In Elm street, from Garden City to Kensington street; in Oak street, from York street to Spruce street; in Spruce street, from Oak street to George street, and in Norton street, from Derby avenue to Chapel street; to William Grandfield. Other contracts awarded are as follows: Belgian pavement on Water street, from Franklin street to Olive street, to Gerhardt Fohlman; fence around Munson Park, to Wm. A. Lincoln; bridge at West Portsea street crossing of the New Haven & Derby Railroad, to Peter Small, and concrete walks on Spireworth Square, to the New Haven Concrete Company.

BRIDGES.

The new bridge over the Delaware at the Water Gap will be 950 feet long.

The Smith Bridge Company, of Toledo, O., has finished a Howe truss bridge, two spans of 140 feet each, over the Mississenewa River, at Marion, Ind., for the Cincinnati, Wabash & Michigan road.

Negotiations are pending between the Indiana, Bloomington & Western and the Chesapeake & Ohio railways for the construction of a bridge over the Ohio River at Huntington, to connect the two systems on the completion of the Eastern Division of the former company.

The Indianapolis & St. Louis Company has changed the plan as to the construction of a bridge over White River. It is to be a single, not a double-track structure. However, the approaches to it will be so constructed that no switches will be used at either end of the bridge, frogs being used instead, so that the I., D. & S. and I., B. & W. trains can run on it as readily as those of the Indianapolis & St. Louis.

RAILROADS.

Colonel Fred. D. Grant has arrived at Houston, Tex., and has begun work on his railroad.

The Baltimore & Ohio Railroad is about to build a double track between McKeesport and Elrods.

The Chicago and St. Louis Railroad has 3,000 men at work and will complete as much as possible this year.

There are 3,300 men employed in the locomotive works at Paterson, N. J., whose wages aggregate $1,650,000 annually.

The St. Paul, Minneapolis & Manitoba Railway was formally opened between Fargo and Grand Forks and the north on the 9th inst.

The Northwestern track is laid to Boom River, seventeen miles east of Dakota City, which point it is expected to reach by July 4.

The Texas & Pacific track has been laid to Big Springs, Tex., 323 miles west of Dallas. Cattle pens and machine shops will be erected there.

The Delaware, Lackawana & Western will finish this year a branch from Rochester to Mount Morris, in Livingston County, to connect with the Buffalo extension.

There is now a specially rapid growth of narrow-gauge railroads in the Southwest. It is claimed that in Texas alone there will be 2,000 miles built in the coming two years.

The Pennsylvania Railroad Company, in view of the enormous business upon the New York branch, is contemplating putting down four tracks between Philadelphia and New York.

The Cincinnati, Indianapolis, St. Louis & Chicago Company are distributing 26,000 cross-ties on the C., L. & C. division, and graveling the entire distance between Templeton and Kankakee.

The road from Rome to Brunswick, Ga., will be named the Cincinnati & Georgia road. It is calculated that it will cost $4,500,000, not including the cost of the Macon & Brunswick road. It will be laid with steel rails throughout.

A couple of thousand tons of steel rails, which are to be laid on the Indiana, Bloomington & Western extension, have already reached Springfield, O., and the coming week several hundred tons will be delivered at the end of the line.

Construction on the Eastern end of the Northern Pacific is being pushed with all possible energy. It is expected that by the close of the year the rails will be laid 400 miles out from Bismarck. This will carry the road far up the Yellowstone.

The new short cut on the Pennsylvania Railroad through Bergen Hill, at the Point of Rocks, Jersey City, has now reached Summit avenue. When it is half across the avenue a bridge will be thrown over the finished part of the cut, and then the other half will be cut through.

A dispatch from Rosenberg, Texas, says: "The New York, Texas & Mexican Railway has established a branch office here. Col. D. E. Hungerford, Vice-President and General Manager, with a corps of engineers, is here. A connection is being graded with the Gulf, Colorado and Santa Fe, and will also connect with the Galveston, Harrisburg & San Antonio road."

Travelers via the Southern route from San Francisco report that for many miles the railroad has men constantly employed in keeping the track clear from drifting sands, the same as Northern roads do for winter snows. This, in connection with the fact that water for the engines has to be carried for hundreds of miles across the desert, shows some of the disadvantages of railroading in that latitude.

The Southern Pacific railroad advancing from the west has crossed the New Mexican line into Texas at El Paso, advancing eastward at a rate that will bring trains to Fort Davis, twenty miles this side of El Paso, by the 1st of August. By that time Gould's Texas Pacific road going westward will reach the Pecos River, leaving only a gap of one hundred and fifty miles to be filled up to complete the through connection.

The largest railroad suit which ever came before the courts of the United States has just been commenced at Santa Fé. It is between the Texas and Southern Pacific Railroad of New Mexico. The suit is brought to recover all that portion of the Southern Pacific built upon the land grant of the Texas Pacific in New Mexico, a tract of 130 miles. A temporary injunction has been granted and a receiver appointed. At least $6,000,000 worth of property is involved in this suit, which has been brought since Jay Gould was elected to the presidency of the Texas Pacific. This is probably the first shot in a big railroad war.

RIVERS AND HARBORS.

It is said that with a little dredging the Iowa River can be made to carry grain barges. Two steamboats are being run on that stream this season.

The pier at the foot of Kentucky avenue, Atlantic City, will be 850 feet long, will contain 43,000 feet of lumber, will be supported on 300 piles and strengthened by 1,600 braces. It is being constructed under the supervision of Captain H. Little and Abraham Reeves, both of Cape May, who built the wooden pier at that place. These gentlemen say that it will be the strongest and best-constructed wooden pier built for the purpose intended.

CANALS.

On the 12th a serious break occurred in the Erie Canal about two miles west of Albion, N. Y., the water flooding and damaging the immediate country. The damage is estimated at $30,000.

NEW PROJECTS.

English capitalists are said to have subscribed $5,000,000 toward building an underground railroad in Chicago.

The directors of the Illinois Central road at their next meeting in New York will take some action as regards building a new depot at Chicago.

The Burlington, Cedar Rapids & Northern Company intends to add about 100 miles of road to its present system by the construction of a new line in Iowa.

The Cincinnati, Indianapolis, St Louis & Chicago is to build a road line from Kankakee to Seneca, and for that purpose has voted an increase of capital stock from 50 per cent. to $6,000,000.

The Delaware & Hudson Railway Company engineers are now making a final survey of the roadway of the Schuylerville & Upper Hudson Railroad. The distance from Mechanicville to Fort Edward is lessened 12 miles by the construction of the new line, and it is expected that the same will be ready for trains by November.

The articles of incorporation of the Myrtle Avenue Branch Railroad Company of the Brooklyn (N. Y.) Underground Railroad Company have been filed with the Secretary of State. The capital stock is $1,000,000 and the company is to continue 100 years. The road is to be three miles in length, and mostly under Myrtle avenue.

Governor Hoyt has issued a charter to the Water Gap & Schuylkill Railroad Company, whose line is to run from Pottsville, passing through Schuylkill, Carbon and Monroe counties to the Delaware Water Gap. The road is to be sixty-five miles long, and the capital stock of the company $3,000,000. Mr. Henry Whelen, of Philadelphia, is president of the company.

A dispatch from Peoria, Ill., says: "Arrangements have been perfected for a magnificent union depot at this place, to cost $400,000. It will be under the supervision of the Peoria & Pekin Union Railway, which has control of all the tracks between Peoria and Pekin. All roads centering here have united in the enterprise, and the work is to be commenced at once. All tracks in the union yards are also to be reconstructed. When completed there will be 35 miles of side track."

The bill legalizing the contract between the Newfoundland Government and the Railway Syndicate Company, of New York, has become a law, and incorporates an American company with a section allowing aliens to hold lands on the same terms as British subjects. The company contract to build a line of 400 miles from St. Johns to the copper mines of Hall's Bay, opening a great grazing, timber, grain and mineral region. It will cost $6,000,000, and be done in three years.

Last week an agreement of incorporation was filed with the Secretary of State at Wheeling, West Va., by the Kanawha Railway Company. It proposes to build a railroad from or near Cabin Creek, in Kanawha County, to a point at or near a point on the Clear Fork of Big Coal River, about a mile above the confluence of Marsh Fork and Clear Fork. The principal office is to be at Wilkesbarre, Pa., and the capital stock is $100,000, divided into shares of $100 each.

A Montreal dispatch says: "The surveys and location of the St. Lawrence South Shore Railway from Dundee to Huntingdon, in this province, have been completed, and contracts are about to be given out for work upon it. The road will connect at Dundee with the Potsdam & Montreal Railway, thereby forming a through route *via* the Rome, Watertown & Ogdensburg railways to Suspension Bridge, connecting at that point with the Great Western Railway, and giving Montreal another through route to Chicago and the Western States."

A corporation has been organized under the general laws of Maine, called the "Bangor and Katahdin Iron Works Railway Company," which has filed its papers in the office of the Secretary of State. The road is to be constructed, mamtained and operated from the Bangor & Piscataquis Railroad in the town of Milo, at or near the depot in that place, to the works of the Katahdin Iron Company in township No. 6, range 9. The road will be seventeen miles in length. The gauge of the road is 3½ ft. The amount of capital stock of the company is $60,000, divided into 600 shares of $100 each.

SPRINGFIELD, Ill., June 10.—Articles of incorporation of the Tamaroa, Mount Vernon & Vincennes Railroad Company have been filed with the Secretary of State. The capital of the company is $1,500,000, and the incorporators and first Board of Directors are Charles B. Cole, of Chester; J. W. K. Murphy, of Pinckney, Ill.; George A. Evans, of Mount Vernon; Robert A. D. Wilbanks, of Mount Vernon, and Alva Blanchard, of Tamaroa. The object is to contract and maintain a line of road from Tamaroa, in Perry County, via Mount Vernon, in Jefferson County, and thence by the most practicable route to a point on the Wabash River opposite Vincennes.

Articles of incorporation have been filed with the Secretary of State of Ohio by Charles Hickox, Henry B. Payne, J. H. Wade, S. T. Everett, W. J. McKinnie and Stevenson Burke, for the purpose of constructing a railroad from or near the Union depot in the city of Columbus, through the counties of Franklin, Fairfield, Hocking and Perry, to a point in Ward Township, Hocking County, near the east line of that county. The company also intend to construct branches to Shawnee, Straitsville and Athens; also, a branch up the Sunday Creek, in Athens County. Branches are also to be constructed to the several furnaces and coal mines near the line of the railroad and branches. The principal office of the company will be located in Columbus. The capital stock, $6,000,000, will be divided into sixty thousand shares of $100 each.

CONTRACTING, MISCELLANEOUS, ETC.

John Busse has been awarded the contract for furnishing the city of Chicago with 1,485,000 sewer brick.

The Joliet steel works continue to increase in capacity, and now employ 2,006 men. The pay-roll for the month ending June 15 will aggregate $94,000.

It is stated that Krupp cannot meet his big gun orders, viz., Roumania, 100; Greece, 700; Sweden, 50; Holland, 120; Italy, 400. Such are Europe's peace prospects.

The Barney & Smith Manufacturing Company recently closed the following large contracts: Central Pacific railroad, for Southern Pacific, 600 freight cars; Cleveland, Columbus, Cincinnati & Indianapolis, 400; Utah Southern, 100, and have also completed 600 for the Cincinnati, Indianapolis, St. Louis & Chicago, 300 for the Central Pacific and a number of other roads. The passenger department is very busy on sleepers for the Central Pacific, Northern Pacific, Wagner, Baltimore & Ohio and Woodruff coaches for a dozen different roads. The firm now employs nearly 1,000 men.

The production of steel in this country has grown to greater proportions than is generally supposed. There are now seventy-three steel works in operation, against thirty in 1870, and the manufacturers of this article are greatly encouraged from the fact that steel is in many instances being used where iron was supposed to be the most desirable. The greater durability of steel makes it the most economical despite the greater first cost, and the gain in the volume of consumption of steel has been greater in proportion than that of iron. The value of steel products, therefore, promises at no distant day to largely exceed the same class of products of iron.

The Eppinger & Russell Creosoting Works are located at the foot of Sixth street, Gowanus Canal, Brooklyn, and occupy a dock front of over 600 feet. There are three cylinders, each 85 ft. in length by 6 ft. diameter, made from the best quality of iron, and put together in the most substantial manner. The heads are movable, weigh over four tons each, and are capable of exerting a pressure of 180 pounds to the square inch. The works have a storage capacity of more than 2,000 barrels of oil. The plant further consists of both vacuum and pressure pumps, made by some of the best makers. The works have a capacity of treating 28,000 ft. of timber per day. The firm have creosoted all the timber required for the immense dykes built by Generals Newton and Michler, in the Raritan and Passaic rivers, Canarsie Bay and Manasquan Inlet; also, the timber for the government pier at Lewes, Del., under the supervision of General Macomb; the flooring for the Vanderbilt mansion, this city, and large quantities of telegraph poles and railroad timbers for the South American trade. The firm have used many hundred tons of dead oil